

Frank Jackson Lake Intensive Basin Survey 2014

Yellow River Basin

FJAC-1: Frank Jackson Lake deepest point, dam forebay. (Covington Co. 31.3018/-86.2804)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM’s 2012 Monitoring Strategy (ADEM 2012).

In 2014, ADEM monitored Frank Jackson Lake as part of the intensive basin assessment of the Yellow River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in Frank Jackson Lake (FJAC-1) during the 2014 growing season (Apr-Oct). Monthly and/or mean concentrations of nutrients [total nitrogen (TN); total phosphorus (TP)], algal biomass/productivity [chlorophyll *a* (chl *a*); algal growth potential testing (AGPT)], sediment [total suspended solids (TSS)], and trophic state [Carlson’s trophic state index (TSI)] from 2014 were compared to ADEM’s historical data and established criteria.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Frank Jackson Lake is classified as a *Fish & Wildlife (F&W)* stream located in the Southern Plains ecoregion (65F). Based on the 2006 National Land Cover Dataset, land use within the 75 mi² watershed is predominantly forest (47%) (Fig. 3). As of January 28, 2016, ADEM has issued a total of 4 NPDES permits within the watershed. Two of those permits are located within 10 mi upstream of the station (Fig. 2).

SITE DESCRIPTION

Frank Jackson Lake at FJAC-1 is a fairly small impoundment of Lightwood Knot Creek which flows into the Yellow River. Frank Jackson Lake has a mean bottom depth of 6.6 m (Table 2) at the sampling location.



Figure 1. Photo of Frank Jackson Lake at FJAC-1.

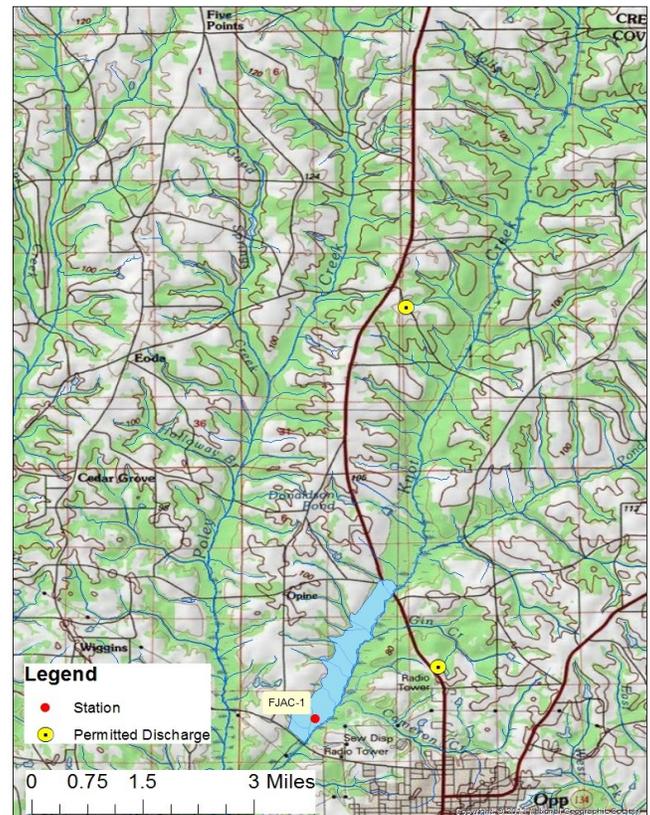


Figure 2. Map of Frank Jackson Lake. Though additional permits may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2014), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013).

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2014 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2.

Table 1: Summary of Watershed FJAC-1

Basin	Yellow R
Drainage Area (mi ²)	75
Ecoregion ^a	65f
% Land use	
Open Water	2%
Developed	Open Space 5%
	Low Intensity 1%
	Medium Intensity 0%
	High Intensity 0%
Barren Land	0%
Forest	Deciduous Forest 15%
	Evergreen Forest 22%
	Mixed Forest 10%
Shrub/Scrub	14%
Herbaceous	2%
Hay/Pasture	17%
Cultivated Crops	10%
Wetlands	Woody 3%
	Emergent Herb. 0%
# NPDES outfalls ^b	TOTAL 4
Construction Stormwater	1
Mining	0
Small Mining	1
Industrial General	2
Industrial Individual	0
No Exposure	0
Municipal	0
Underground Injection Control	0

a. Southern Pine Plains and Hills

b. #NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

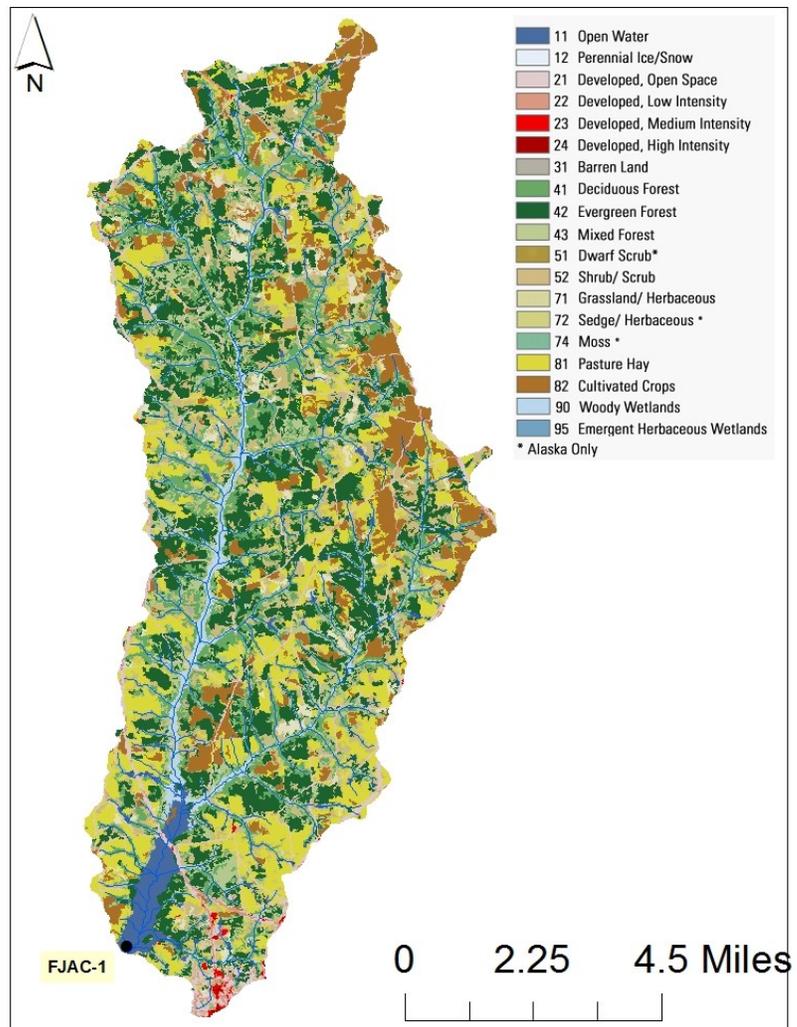


Figure 3. Land use within Frank Jackson Lake at FJAC-1.

The mean growing season TN value increased in 2014 from the 2012 sampling season. (Fig. 4). Monthly TN concentrations were highest in April and May.

The mean growing season TP concentration slightly increased in 2014 (Fig. 4). Monthly TP concentrations were highest in August.

In 2014, the growing season mean chl *a* value was higher than 2012 but lower than 2009 (Fig. 4). Monthly chl *a* concentrations were highest in July and August.

Mean TSI remained eutrophic in 2014. Monthly TSI reached eutrophic conditions June-September (Fig. 4).

The mean growing season TSS value was higher in 2014 than 2007-2012 (Fig. 5). Monthly TSS concentrations were highest in July.

AGPT results show that Frank Jackson Lake continues to be phosphorous limited in 2013 (Table 3). The mean maximum standing crop (MSC) value was 2.82 mg/L, which is below the 5.0 mg/L value that Raschke and Schultz (1987) defined as protective of reservoir and lake systems.

DO concentrations were below the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) in September (ADEM Admin. Code R. 335-6-10-.09) (Fig. 6).

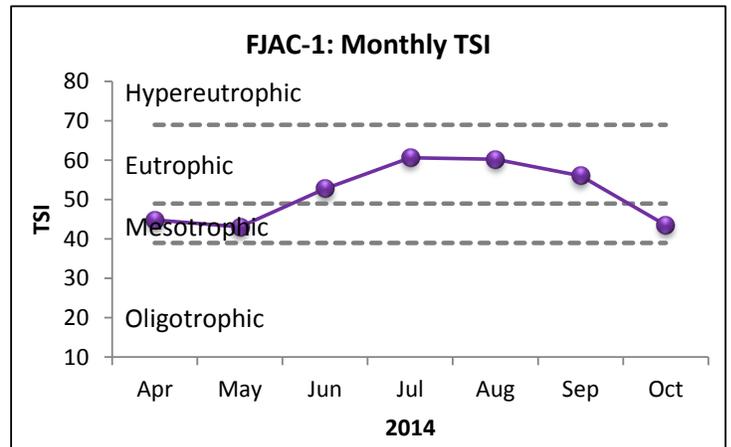
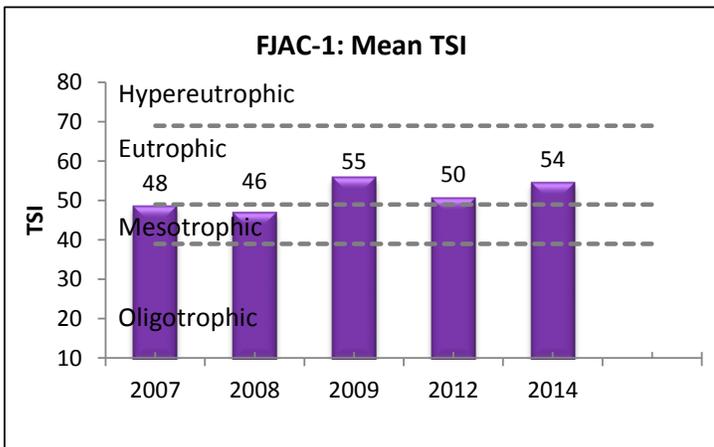
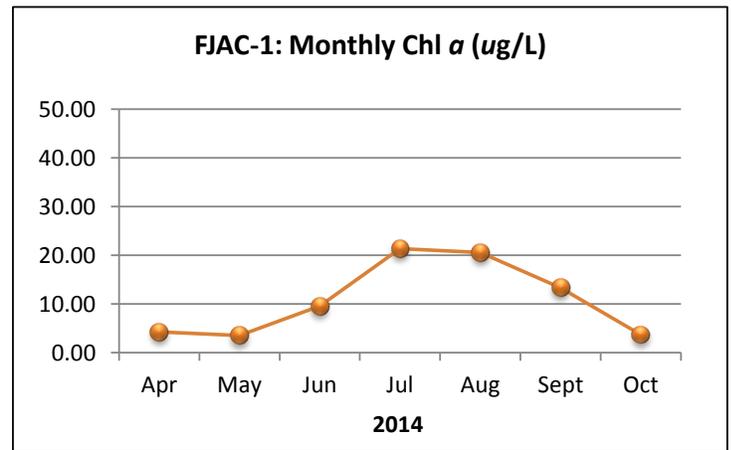
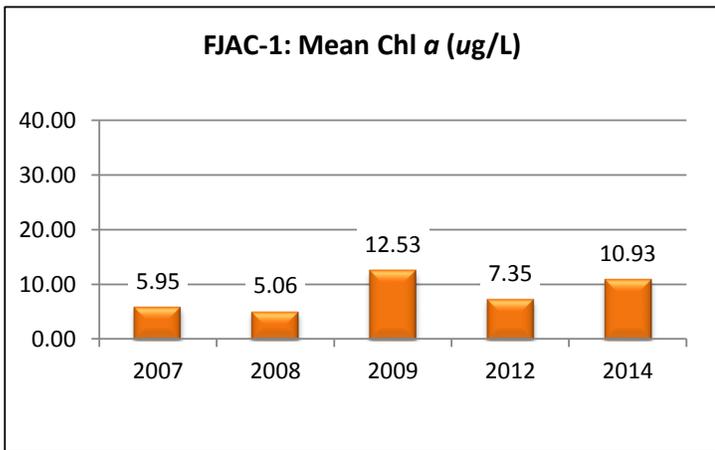
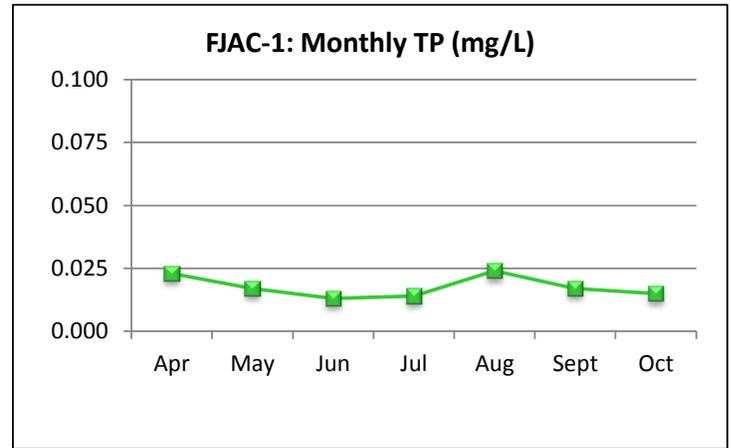
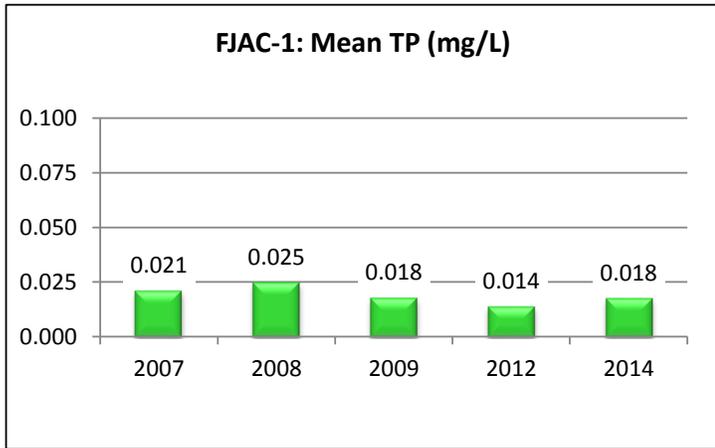
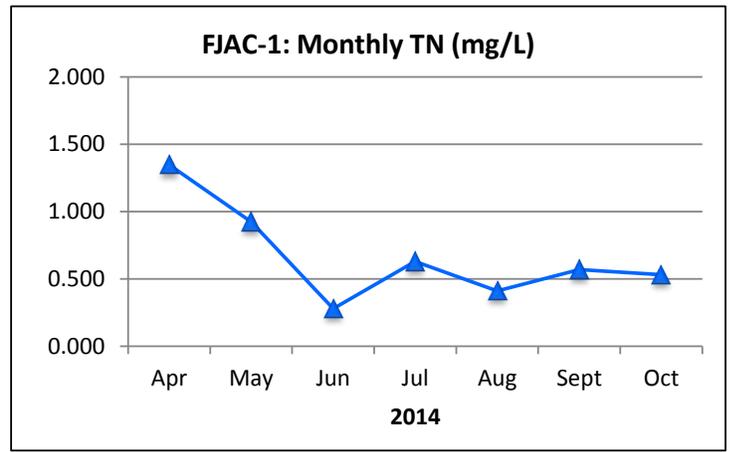
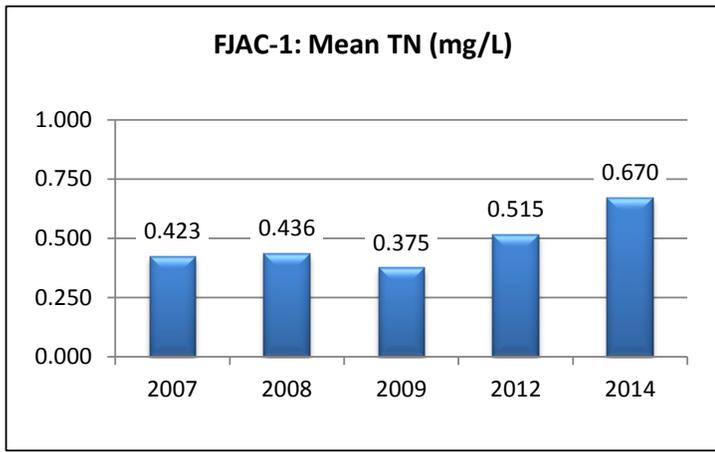


Figure 4. Mean growing season (2003-2014) and monthly (April-October, 2014) TN, TP, chl *a* and TSI measured in Frank Jackson Lake. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

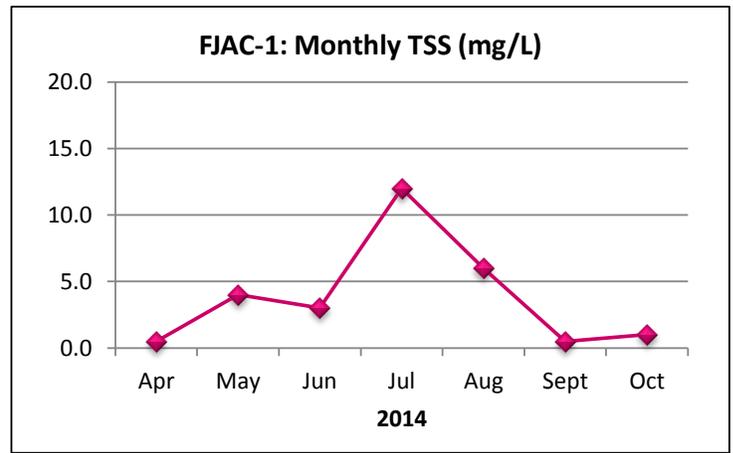
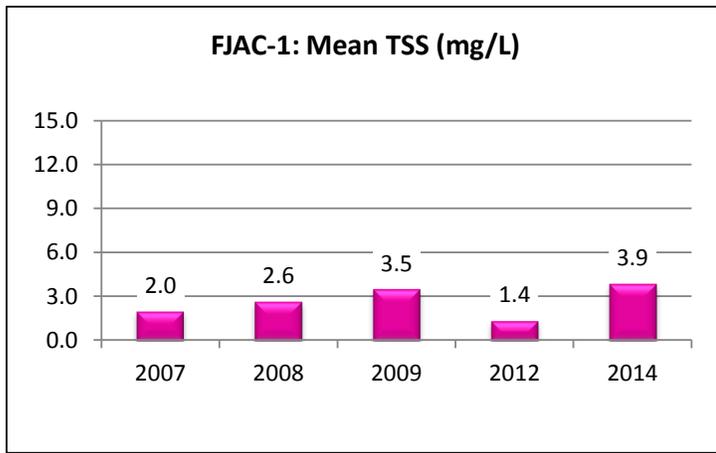


Figure 5. Mean growing season and monthly TSS measured in Frank Jackson Lake.

Table 2. Summary of water quality data collected April-October, 2014. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

FJAC-1	N	Min	Max	Med	Avg	SD
Physical						
Turbidity (NTU)	8	4.0	11.6	5.9	6.3	2.5
Total Dissolved Solids (mg/L)	7	17.0	53.0	31.0	33.3	13.9
Total Suspended Solids (mg/L)	7	< 1.0	12.0	3.0	3.9	4.1
Hardness (mg/L)	4	7.6	13.0	11.8	11.0	2.5
Alkalinity (mg/L)	7	5.7	13.0	10.7	9.9	2.4
Photic Zone (m)	7	2.22	3.26	2.72	2.75	0.36
Secchi (m)	7	0.96	1.70	1.14	1.22	0.30
Bottom Depth (m)	8	6.2	6.7	6.6	6.5	0.2
Chemical						
Ammonia Nitrogen (mg/L)	7	< 0.006	0.191	0.003	0.040	0.071
Nitrate+Nitrite Nitrogen (mg/L) [†]	7	< 0.001	0.138	0.003	0.039	0.054
Total Kjeldahl Nitrogen (mg/L)	7	0.276	1.210	0.569	0.631	0.311
Total Nitrogen (mg/L) [†]	7	< 0.279	1.348	0.570	0.670	0.359
Dissolved Reactive Phosphorus (mg/L) [†]	7	< 0.003	0.004	0.003	0.003	0.001
Total Phosphorus (mg/L)	7	0.013	0.024	0.017	0.018	0.004
CBOD-5 (mg/L)	7	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)	7	3.0	4.1	3.8	3.6	0.5
Biological						
Chlorophyll a (ug/L)	7	3.56	21.36	9.61	10.93	7.75
E. coli (col/100mL) [†]	3	2	7	3	4	3

[†] = one or more of the values is an estimate; N = # samples.

Table 3. Algal growth potential test results (expressed as mean MSC dry weights of *Selenastrum capricornutum* in mg/L) and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes (Raschke and Schultz 1987).

FJAC-1	MSC	Limiting Nutrient
6/28/2007	1.76	PHOSPHORUS
8/1/2007	1.42	PHOSPHORUS
8/29/2007	1.63	PHOSPHORUS
9/3/2008	2.65	PHOSPHORUS
8/20/2009	.98	PHOSPHORUS
8/27/2014	2.82	PHOSPHORUS

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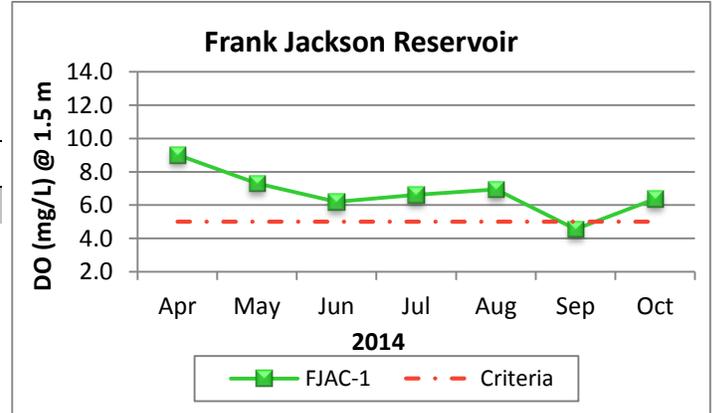


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Frank Jackson Lake, collected April-October 2014. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

- ADEM. 2014. Standard Operating Procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.
- ADEM. 2013. Quality Management Plan (QMP) for the Alabama Department of Environmental Management, Alabama Department of Environmental Management (ADEM), Montgomery, AL. 58 pp.
- ADEM. 2012. Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring in Alabama. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 78 pp.
- ADEM. 2012. State of Alabama Water Quality Monitoring Strategy June 19, 2012. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 88 pp. <http://www.adem.alabama.gov/programs/water/wqsurvey/2012WQMonitoringStrategy>
- Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.09). 2010. Specific Water Quality Criteria. Water Quality Program. Chapter 10. Volume 1. Division 335-6.
- Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.11). 2010. Water Quality Criteria Applicable to Specific Lakes. Water Quality Program. Chapter 10. Volume 1. Division 335-6.
- Carlson, R.E. 1977. A trophic state index. *Limnology and Oceanography*. 22(2):361-369.
- Raschke, R.L. and D.A. Schultz. 1987. The use of the algal growth potential test for data assessment. *Journal of Water Pollution Control Federation* 59(4):222-227.